The archive and the ark: bird specimen data in conservation status assessment

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SUMMARY

The enterprise of naming all life-forms on earth reached its zenith in the years 1850–1950, but it is often forgotten that our knowledge of the *distributions* of species stems primarily from the same museum endeavour. However, various good reasons dictate that not all material deposited in museums is documented in the public domain, leaving the conservationist with a rich body of essentially new (if commonly predictable) information for use in fixing the ranges (and indeed ecologies) of threatened species. By its use of museum material, BirdLife International's Red Data Book programme has found numerous significant range extensions (whose effect—predictably, given that more localities indicate a wider extent of occurrence and stronger population—is generally to diminish the concern with which the species in question are regarded). Drawing on 60 museums, *Threatened birds of the Americas* used unpublished museum range and ecological data in 232 (77%) and 138 (46%) species accounts respectively. Drawing on 30 museums, *Threatened birds of the Philippines* identified a total of 830 localities, 228 (27%) of which were based *solely* on museum evidence. Museums also hold contentious specimens that require re-evaluation, but there is disconcerting evidence of the decline of the specimen-based taxonomy which helps to bind conservation and science together.

Naming and placing

All modern endeavours concerning biological diversity—its manifestations, patterns, measurement and conservation—rest almost entirely on the extraordinary programme of classification that natural history museums in Europe and the U.S.A. accomplished mainly in the period 1850–1950. This great century of accumulation, evaluation and synthesis of biological material was facilitated and fuelled by European capitalist-imperialist expansion (victory in the Second Opium War, suppression of the Indian Mutiny, and so on) and by the socially and intellectually convulsive insights of Darwin & Wallace (1858). It was effectively finished off by the colonial dismantlings in the aftermath of the Second World War (70 independent sovereign states in 1945; over 170 in 1975) and by the decisive (if debatable) observation of Mayr (1946) that 'the period of new discoveries is practically at an end'.

In that period, the vast majority of all known vertebrate (and perhaps invertebrate and plant) reference material was assembled—often (it is worth remembering) at the great personal risk and expense of the collectors themselves (see, e.g., Stewart 1984, Mearns & Mearns 1998:40-42). Taxonomy was *the* biological science of the late nineteenth century, and its practitioners worked with single-minded energy on the identification and attribution of this flood of material, issuing catalogues and accounts of collections with a regularity and thoroughness that defies modern comparison. The British Museum's million or so bird specimens were almost all acquired during this period, thus at an average of 10,000 a year, or some 40 every working day (by 1990 the intake was under 50 *per year*: Knox & Walters 1992), and in the years 1874–1898, when the hundred-year period in question was less than half run, the trustees issued a catalogue of its avian material, running to an encyclopaedic 27 volumes with an accumulated length of very approximately 16,000 pages. This work was descriptive and synthetic: everything was assigned an identity by matching it to published evidence, so that huge synonymies were accumulated as taxonomists sought to determine the status of specimens and the priority of names associated with them. A major element in this process was the provenance of the material, which allowed museum workers to anticipate whether they were dealing with species already documented elsewhere. As a consequence, from this monumental labour a coherent pattern of the *distributions* of species began, slowly but steadily, to emerge.

It is remarkable how slight public appreciation has been and remains of this crucial role played by museums in defining both species *and* ranges. Our entire understanding of faunas and floras around the world stems from the great systematics enterprise, begun effectively with Linnaeus two and a half centuries ago and now—at a point when it might be thought no longer achievable or even necessary—formulated outright (as for example 'Systematics Agenda 2000': *Biodiversity and Conservation* 4 no. 5 [1995]; and the 'All Species Inventory': Lawler 2001, Gewin 2002), of identifying and classifying every one of the species alive today on earth; yet the debt, owed very largely to the great nineteenth-century museums of Europe and North America, continues to go almost entirely unacknowledged.

Undocumented material: new voyages of discovery

For various reasons, only a moderate proportion of the information attaching to holdings in a natural history museum is likely ever to be published. There is, to begin with, the time-lag between acquisition and classification, given the predictable difficulties in identifying parts of the material. (It is worth making the point that museums create their own in-house expertise: taxonomy is a skill acquired by its *practice*, and the speed and accuracy of workers at any given point is almost certainly correlated with the length of their employment.) Second, in any working museum the appropriate staff must inevitably be otherwise engaged, so that sometimes even commissioned collections will be set aside for the sake of other priorities and commitments. Third, when material is bought or bequeathed or delivered in bulk—i.e. when acquisitions occur randomly (see, e.g., Kitchener & McGowan 2003, this issue)—the human resources needed to undertake a full review of incoming stock are unlikely to be available for years or even decades (if at all). Fourth, it is not in any case the remit of museums publicly to itemise their holdings (despite the precedent of certain institutions in the nineteenth century): reasons of economy combine with the immediate interests of science in restricting publications to the more significant additions and the insights they bring. Fifth, the financial fortunes of museums vary over time like all other institutions, public or private, and inevitably many have lost the power to curate or publish on their holdings.

As a consequence of all this, a great deal of information associated with museum material never enters the public domain, and represents a resource awaiting any number of future uses. One might expect that, even if the information itself remains undisclosed to the public, the public would at least be aware that such information exists; yet this is not (or at least not always) so, nor is it even the case that directly interested parties, such as natural history students and conservationists, who stand to gain most from the resource, recognise the fact; indeed, even curatorial staff themselves sometimes seem oblivious to the importance of this aspect of the material in their care. The fact remains, however, that so much unpublished information resides on the labels of specimens in most major and many minor natural history museums around the world that a visit to any one of them represents something of a voyage of discovery in miniature: even today, the opening of a cabinet door can bring a researcher face to face with startling new evidence, intriguing new puzzles, and even—on the rarest occasions—hitherto unrecognised new species.

This circumstance has been particularly important for the assessment of bird species conservation status at the global level. The quality of such assessments depends directly on the completeness of the information assembled (Collar 1996). Naturally the majority of information comes from published sources, and much of it is supplemented and updated by the personal testimony of field experts. However, the material stored in museums, although sometimes ancient and ostensibly therefore irrelevant, represents another data source which should not be neglected or underestimated. Since the early 1980s museums have played an integral role in the data-generating processes of BirdLife's Red Data Book programme and, as the following examples indicate, have contributed in large measure to a better understanding of the true ranges of many species. This in turn has affected perceptions over their conservation needs and options, the general effect—by increasing the number of locations for species, and therefore the sense of their numerical status—being to *reduce* the sense of alarm over status that the thitherto less complete published data have inevitably tended to create.

Three policies followed in the Red Data Book programme are relevant here. The first is the obligation to cite every source from which an item of information is derived. The second is the decision *not* to cite information from unpublished sources if it already exists in published sources. The third is the requirement that, wherever possible, a locality record for a species should also have a month and year attached. Therefore any reference in a Red Data Book species account to a museum-derived item of information indicates something that cannot be (or at least has not been) found in the literature; this may be a record representing an entirely new locality, but it may also simply be an extra datum that adds to published information (for example, in museum catalogues and accounts of particular collections, localities were sometimes given without dates; these can often be supplied by direct reference to the specimen evidence).

With this clarification, it is possible to understand how munificent a contribution museum data have made to the process of global conservation status assessment in birds. *Threatened birds of the Americas* (Collar *et al.* 1992) documents 302 species in full, with every reasonable attempt having been made to assemble as much information as possible relevant to their conservation (as token of which the bibliography itemises some 2,600 references and occupies 80 pages of text, while some 550 correspondents are acknowledged for information provided through personal communications). In spite of this effort, no fewer than 232 (77%) of these accounts carry previously unpublished range data from museums; and 138 (46%) carry previously unpublished ecological data from museums. No fewer than 60 museums are listed as sources of information in the introduction to the book.

While of course it cannot be claimed that all these items were of particular significance—some, for example, merely established an entirely predictable locality, food or clutch size—the figures clearly suggest that increased substance and authority was brought to the book through the addition of museum data. Some individual items of information were, however, particularly important, and here we select some of these as well as others from the companion volumes *Threatened birds of Africa and related islands* (Collar & Stuart 1985) and *Threatened birds of the Philippines* (Collar *et al.* 1999).

International range extensions

The BirdLife Red Data Book programme has uncovered and published first species records for at least five countries, namely: Dwarf Tinamou *Taoniscus nanus* in Argentina (two specimens in BMNH), Chestnut-throated Spinetail *Synallaxis cherriei* in Colombia (two specimens in FMNH), White-necked Picathartes *Picathartes gymnocephalus* in Guinea (five specimens in ZFMK), Grey-necked Picathartes *P. oreas* in Equatorial Guinea (specimen in EBD; information passed to and first published by Ash 1991) and Nimba Flycatcher *Melaenornis annamarulae* in Ivory Coast (specimen in MNHM). Collar *et al.* (1992) also provided the first unambiguous records of Yellow Cardinal *Gubernatrix cristata* from Paraguay (specimens in BMNH, also MCZ). Clearly one effect of these discoveries is to extend the responsibility for the conservation of the species in question to new countries, although this is not to suggest that it in any way diminishes the responsibility of those countries to which the species were previously believed confined.

State or province range extensions

Significant within-country range extensions (involving new political subunits or mountain ranges) based solely on museum material have been documented for several countries in the Caribbean and Central and South America, for example: records of Rusty-flanked Crake *Laterallus levraudi* in Carabobo and Miranda states, Venezuela (12 specimens in AMNH, ANSP, COP, USNM); Chestnut-bellied Hummingbird *Amazilia castaneiventris* in Santander, Colombia (nine specimens in DMNH, LACM, WFVZ); Black Inca *Coeligena prunellei* in the Central Andes of Colombia (specimen in MHNUC); Blue-headed Quail Dove *Starnoenas cyanocephalus* in Guantánamo, Cuba (multiple specimens from seven localities in AMNH, BMNH, CM, FMNH, MCZ, USNM); Eared Quetzal *Euptilotis neoxenus* in Nayarit, Zacatecas and Michoacán, Mexico (14 specimens in BMNH, DMNH, MCZ, USNM); Keel-billed Motmot *Electron carinatum* in Tabasco, Mexico (specimen in USNM); Three-toed Jacamar *Jacamaralcyon tridactyla* in Espírito Santo, Brazil (six specimens in MNRJ); Cuban Flicker *Colaptes fernandinae* in Guantánamo, Cuba (multiple specimens—including 39 from around Guantánamo town and bay—from nine localities in MNHM, ROM, USNM); Imperial Woodpecker *Campephilus imperialis* in Nayarit, Mexico (specimen in MLZ); Moustached Woodcreeper *Xiphocolaptes falcirostris* in Goiás and Pernambuco, Brazil (specimens in MNRJ and MZUSP respectively); Multicoloured Tanager *Chlorochrysa nitidissima* in Caldas, Colombia (specimen in USNM); and Turquoise Dacnis *Dacnis hartlaubi* in Quindío, Colombia (specimen in ICN).

Significant proportions of range data

Some threatened species, although relatively unknown in the literature, prove to be surprisingly well represented by museum specimens, and thus our knowledge of their ranges has been substantially enhanced. Perhaps the most striking example is the White-tailed Sabrewing *Campylopterus ensipennis*, established by Collar *et al.* (1992) as known from 23 localities, although only 5–6 of them had until that point been published, the remaining 17–18 being based solely on museum specimens (in AMNH, ANSP, BMNH, CM, COP, FMNH, LACM, USNM, YPM; see Fig. 1). Other notable cases include Nahan's Francolin *Francolinus nahani*, six of whose 11 known sites (in 'Zaïre') were established from museum material (in IRSNB, MNHM, MRAC); Yellow-eared Parrot *Ognorhynchus icterotis*, with 13 'museum' sites out of 23 all told (in AMNH, ANSP, BMNH, FMNH, LACM, MCZ, MECN, USNM, YPM; see Fig. 2); Giant Antpitta *Grallaria gigantea*, with 12 out of 21 (in AMNH, ANSP, BMNH, FMNH, IRSNB, MHNG, MNHN, USNM, WFVZ); Cochabamba Mountain-finch *Poospiza garleppi*, with seven out of 13 (in BMNH, CM, MCZ, NRM, ZMUC); and Saffron-cowled Blackbird *Xanthopsar flavus*, with 31 out of 71 (in AMNH, BMNH, FMNH, MCN, MNHN, MNHNM, MNRJ, MZUSP, UMZC).

Range extensions in Madagascar

In the century before the Second World War the birds of Madagascar were heavily collected by American, Dutch, English, French and German explorers, but even today the island remains inadequately documented ornithologically, nor has the breadth of the existing museum material been fully appreciated or utilised. The publication by Langrand (1985) of a significant but overlooked collection of Malagasy birds in the museum in Grenoble was an important reminder of the possibilities of provincial museums (see Roselaar 2003, this issue). In the early 1980s the most recent book available on the Malagasy avifauna dated back to 1970, and subsequent information on the rarest species and their habitats was largely anecdotal. Plotting

Fig. 1. The range of White-tailed Sabrewing *Campylopterus ensipennis*. Black circles are localities identified from published sources. Grey circles are localities identified from unpublished museum specimens.

the ranges of these birds was crucial to understanding the severity of their plight, and the museum evidence of north-west Europe (no budget then existed for Red Data Book research further from Cambridge, U.K., than Frankfurt-am-Main) proved to be indispensable. From it came proof of (at least former) occurrence of the Madagascar Fish-eagle *Haliaeetus vociferoides* on the north-east coast (specimen in RMNH); Brown Mesite *Mesitornis unicolor* as far north as Antongil Bay (specimens in RMNH), a range extension of 300 km; Scaly Ground-roller *Brachypteracias squamiger* as far south as Andohahela (specimen in SMF), a range extension of 750 km; Pollen's Vanga *Xenopirostris polleni* as far south as 30 km north of Taolanaro (Fort Dauphin) (specimen in MNHN), a range extension of 350 km (information which reduced the threat status of the species from the highest category in which it had been placed by King [1978-1979]); and Madagascar Yellowbrow *Crossleyia xanthophrys* south to the Betsileo region (specimen in BMNH), a range extension of some 250 km.

Range and natural history parameters in the Philippines

Following volumes on threatened birds in Africa and the Americas, the BirdLife Red Data Book programme turned in the mid-1990s to Asia. However, because the Philippines had recently emerged as the world's leading nation for the highest number of highly threatened endemic bird species (Collar *et al.* 1994:24), it was felt appropriate to dedicate a volume exclusively to that country; hence *Threatened birds of the Philippines* (Collar *et al.* 1999).

The Philippines has strong historical and cultural links with the U.S.A., and the museum tradition has been maintained in the country ever since the one-time explorer D. C. Worcester established R. C. McGregor in the Philippine National Museum at the start of the twentieth century (see Dickinson *et al.* 1991:433). The unfortunate destruction in the Second World War of the collections that McGregor and his colleagues had amassed (Sibley 1946) was in large part compensated through the remarkable energies of D. S. Rabor (Kennedy & Miranda 1998), and indeed considerable quantities of his specimens were placed abroad, particularly with U.S. museums. Chicago's Field Museum (FMNH) alone acquired no fewer than 12,500 Rabor specimens (D. E. Willard *in litt.* 2000), and the Delaware Museum of Natural History (DMNH) accumulated material from the expeditions and purchases of J. E. duPont (some involving Rabor) in the lead up to (and for a short time after) the publication of his *Philippine birds* (duPont 1971).

Fig. 2. The range of Yellow-eared Parrot *Ognorhynchus icterotis*. Black circles are localities identified from published sources. Grey circles are localities identified from unpublished museum specimens.

Threatened birds of the Philippines covers 65 species in full, cites around 625 references and acknowledges 104 personal contacts and 30 museums (14 North American, 7 continental European, 6 Philippine, 2 British and 1 Japanese). A total of 830 localities were identified, 228 (27%) of which were based *solely* on museum evidence. We map two species by way of example: Blue-capped Kingfisher *Actenoides hombroni* (22/34, 65%; Fig. 3) and Palawan Hornbill *Anthracoceros marchei* (14/27, 52%; Fig. 4). An even more remarkable circumstance is the Mindanao distribution of Azure-breasted Pitta *Pitta steerii* (it also occurs on Samar, Leyte and Bohol): Collar *et al.* (1994) mistakenly thought the species restricted on Mindanao to the Zamboanga Peninsula, missing two publications from 1993 which reported it from Bislig on the other side of the island, but even so it proves to be in various other parts of the island, with no fewer than 15 of its 18 localities there being derived from previously unpublished museum material.

One notable trend, partly discernible on the maps used, is the way museum material highlights the importance of Samar. Samar is the sister island of Leyte, but

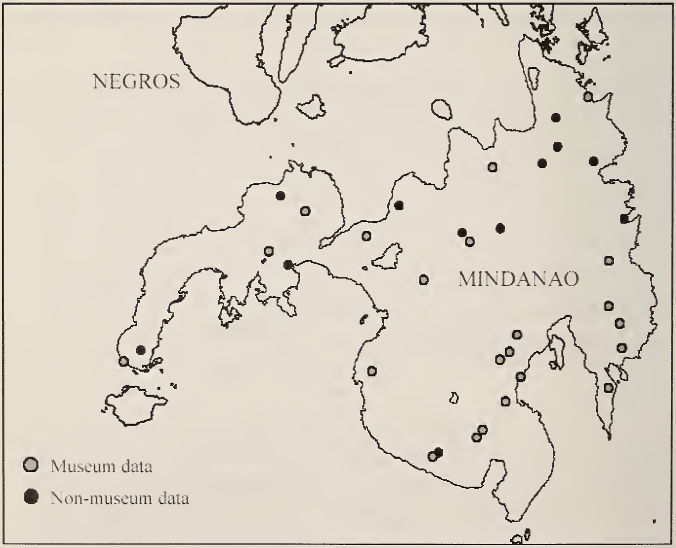

Fig. 3. The range of Blue-capped Kingfisher *Actenoides hombroni*. Black circles are localities identified from published sources. Grey circles are localities identified from unpublished museum specimens.

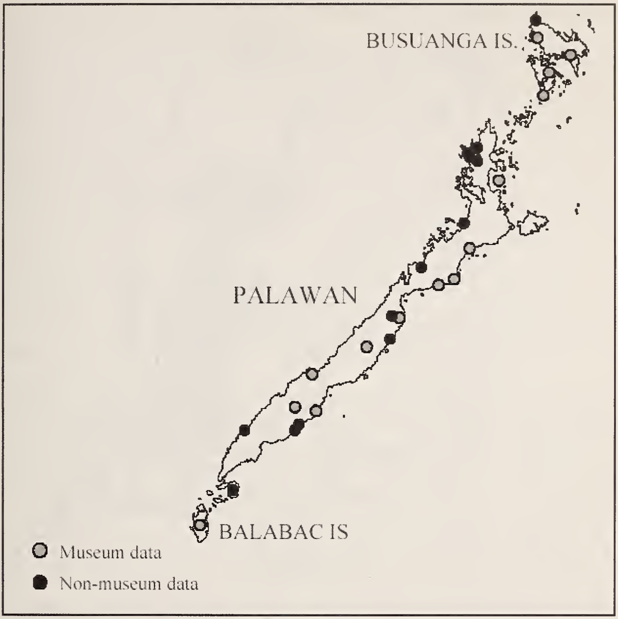

Fig. 4. The range of Palawan Hornbill *Anthracoceros marchei*. Black circles are localities identified from published sources. Grey circles are localities identified from unpublished museum specimens.

whereas Leyte was the subject of a major review by Parkes (1973), Samar has suffered almost complete neglect, with only one paper in the entire twentieth century (Rand & Rabor 1960) devoted even in part to the island's avifauna. Consequently we find that of its 82 localities for threatened species, no fewer than 49 (60%) are derived solely from museum evidence. Without this significant extra body of testimony, Samar would have remained undistinguished and irrelevant to avian and very possibly biodiversity conservation in the Philippines. Moreover, when forest cover is overlaid it transpires that a substantial part of the island is as yet intact; and when logging concessions and protected areas are added, it further emerges that the situation is poised to change rapidly for the worse, and that not a single protected area is in place to mitigate the circumstance (see Fig. 5). When this was disclosed at a priority-setting meeting held after *Threatened birds of the Philippines* went to press, it precipitated a major initiative, with USAID/Global Environment Facility support,

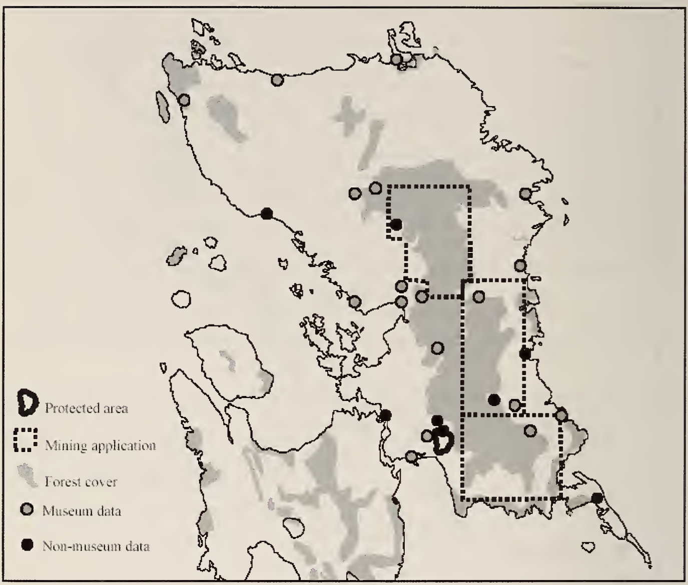

Fig. 5. Point-locality records of threatened birds on Samar, Philippines. Black circles are localities identified from published sources. Grey circles are localities identified from unpublished museum specimens.

to develop a large national park on the island (N. A. D. Mallari verbally 2000). If this duly comes to fruition, it will be in large measure to museum data that future generations will be indebted.

Implications for species status assessment

The fundamental drawback in using museum data is that they are, inevitably, out of date, usually by decades and sometimes by over a century, and therefore there is a strong possibility that the 'new' sites revealed have long become 'old' sites in terms of their avifauna. Habitat destruction has been proceeding so fast in recent decades that we would guess that fewer than 50% of unpublished museum localities still might be sufficiently intact to be available for conservation management. Thus—while always accepting that forest cover overlays tend to be highly schematised and inaccurate—the map of Samar (Fig. 5) shows the elsewhere undocumented collecting sites as all sitting at the edge of known forest, and it is probably the case that most of them have now lost this original habitat.

Even so, it is hardly surprising that the chief effect of the addition of unpublished museum data to information on the distribution of threatened species must be, in general, to reduce the degree of threat under which the species are judged to labour. What basically happens is that the museum data fill out the more expected parts of the map (largely true in Figs. 2–4 and even in Fig.1). After all, really surprising range extensions represented by museum specimens commonly *are* reported in the literature. Inevitably, therefore, it tends to be the rather less interesting material that is allowed to sit undocumented in a cabinet, but even so it would be greatly mistaken to underrate the importance of the corroboration this material furnishes. Again and again we find that species' range maps, as published in otherwise authoritative and revered handbooks and fieldguides, are inaccurate, the product of assumption overlain on assumption. With threatened species, of course, it is particularly important to minimise the use of non-precautionary assumption, and the patient documentation of their ranges, however predictable some of it may be, represents a cardinal obligation in the quest for best judgement.

Equally important is the greater opportunity that a suite of previously unknown sites offers to a conservation manager contemplating the best options for attempting to secure a species's long-term future. This includes the chance to identify key areas based on sympatry of threatened species at given sites. Using the data in Collar *et al.* (1992), Wege & Long (1995) were able to highlight several such areas based exclusively on museum material, for example Parnaguá and Corrente (Piauí, Brazil), from collections made in 1927 and 1958; Santa Ana (La Paz, Bolivia) in 1934; Serranía del Baudó (Chocó, Colombia) in 1912 and 1940; Valle de Yunguilla (Azuay, Ecuador) in 1940 and 1961; Horqueta (Concepción, Paraguay) in 1933 and 1938; Cajabamba (Cayamarca, Peru) in 1894; and San Esteban (Carabobo, Venezuela) in 1875 and 1945.

Unworked material: new insights on distributional and taxonomic status

Ever since point-locality data were deployed in the highly incomplete *Atlas der Verbreitung paläarktischer Vögel* (1960–1989) and the British Museum's two atlases of speciation in African birds (Hall & Moreau 1970, Snow 1978), the fundamental rigour and honesty inherent in this form of range mapping has been self-evident. Sadly, however, it is also extremely labour-intensive and, apart from such rare cases as *Threatened birds of the Philippines* or Paynter's *Nearctic passerine migrants in South America* (1995), point-locality mapping has almost always been used only for single species, sometimes with extensive use of museum data, e.g. Hook-billed Bulbul *Setornis criniger* and the White-throated Babbler *Malacopteron albogulare* (Sheldon 1987), Blue-cheeked Amazon *Amazona dufresniana* (Wege & Collar 1991), Bornean Bristlehead *Pityriasis gymnocephalus* (Witt & Sheldon 1994) and Bearded Tachuri *Polystictus pectoralis* (Collar & Wege 1995). Nevertheless, some of these single-species exercises have a particular value in illustrating the ways in which museum material can transform the received wisdom represented by maps based on less rigorous sources. The following examples relate to elevation, range and date, respectively.

GURNEY'S PITTA ***Pitta gurneyi*** In early 1986 the only hard evidence for the survival of Gurney's Pitta was a live captive bird in Bangkok; even so, the species could then have been declared extinct under CITES criteria, as the last published sighting in the wild had been 50 years previously in 1936, when four birds were collected for Meyer de Schauensee (1946). Curiously, however, a major review of rare birds in Thailand had mapped it as present throughout the forests of the peninsula (Bain & Humphrey 1982), strongly suggesting that alarm for the species was premature. By contrast, the tracing of over 100 specimens of the species and the mapping of every published and unpublished locality (Collar *et al.* 1986) allowed the opposite conclusion to be drawn. It emerged that all sites except one (Meyer de Schauensee's!—apparently owing to deliberate mislabelling by his collectors, intending to suggest that they had ascended a mountain when they had not: Rasmussen & Prŷs-Jones 2003, this issue) were in the *level lowlands*. Accordingly the emphasis of the search for the species was shifted and, with the help of a trade tip-off, the species was rediscovered in June 1986, just in time to initiate conservation measures at what was then the only viable remaining site in Thailand and what is now the only one known in the world (Round & Treesucon 1986, Gretton *et al.* 1993). It was a cause of considerable dissatisfaction that Bain & Humphrey's 1982 map somehow managed to be republished unaltered, in greatly enhanced format (Humphrey & Bain 1991), five years after the truth about Gurney's Pitta was set forth in the public domain.

PLAIN-POUCHED HORNBILL ***Aceros subruficollis*** Both 'editions' of *Birds to watch*, the abbreviated Red Data Book which updates the world list of threatened birds, included Plain-pouched Hornbill, and both credited Kemp (1988) for determining the characters that separate it from Wreathed Hornbill *A. undulatus* (Collar & Andrew 1988, Collar *et al.* 1994). Even so, Kemp (1995) was evidently unable to apply his insights to the breadth of museum material available, since he mapped the species as occurring throughout Myanmar and into north-east India, and shaded in Peninsular Malaysia and Sumatra as possible parts of the range. Only with the detailed inspection and analysis of museum specimens by Rasmussen (2000) has a clarification of the range of the species been achieved, and on this basis it proves to be almost as limited as the original range of Gurney's Pitta, extending from the Thailand–Malaysia border north to Toungoo in south-central Myanmar. The consequences of this important insight are too obvious to state.

VEERY ***Catharus fuscescens*** Work driven by J. V. Remsen, attaching times of year to point-locality records of migrant birds in South America, has begun to revolutionise our perceptions of their annual spatio-temporal patterns (see, e.g., Remsen & Parker 1990, Marantz & Remsen 1991). A striking example involves the Veery, which has been mapped in several publications in the past—including the excellent Paynter (1995)—as occupying a significant segment of northern South America during the boreal winter period. These maps are not 'wrong'; but they are inevitably construed as implying an undifferentiated spread of the population through the areas mapped for the duration of its residency there. By contrast, mostly using museum label data, Remsen (2001) has demonstrated that the Veery undertakes a long loop movement through South America involving a mid-winter pause in a circumscribed area of Brazil in or near the basin of the Rio Xingú. It turns out therefore that the Veery has a much smaller winter range than a simple map would have us believe, because each general staging area in its protracted non-breeding circuit is far smaller than the total area it visits. The loss of any one area, considered as a proportion of the whole, would not result merely in the loss of an equivalent proportion of the bird's population; rather, it might result in the loss of its *entire* population.

The evaluation of problematic specimens

Specimens that defy classification generally qualify as 'undocumented material'. In some cases the matter may be genuinely intractable; in others it may be more one of the experience and ability of the taxonomists. Olson (1986) observed that unique specimens tend to be regarded as 'freaks, hybrids, or... subspecies' and thus 'overlooked and ignored'. It requires considerable time and dedication to investigate such material and attempt to resolve the problems, simply because the returns on such endeavours may be so small. Nevertheless it clearly matters to conservation whether one or a small series of apparently anomalous specimens represents a species or not.

Collar & Stuart (1985) treated at least two taxa known from single specimens over which serious taxonomic doubts have been raised, namely White-chested Tinkerbird *Pogoniulus makawai* and Red-tailed Newtonia *Newtonia fanovanae*. Collar *et al.* (1992) did the same with Magdalena Tinamou *Crypturellus saltuarius*, Coppery Thorntail *Popelairia letitiae*, Táchira Emerald *Amazilia distans*, White-masked Antbird *Pithys castanea*, Cone-billed Tanager *Conothraupis mesoleuca*, Cherry-throated Tanager *Nemosia rourei* and Hooded Seedeater *Sporophila melanops*. Four of these, Coppery Thorntail (Graves 1999), White-masked Antbird (LSUMZ–MHNJP project rediscovery in 2002: D. F. Lane *in litt.*), Red-tailed Newtonia (Goodman & Schulenberg 1991) and Cherry-throated Tanager (Pacheco 1998), have proved to be genuine, while one, Táchira Emerald, has been judged invalid (Weller & Schuchmann 1997, Graves 1998), and another, White-chested Tinkerbird, has been quietly dropped as 'generally considered no more than [an] aberrant individual' of Yellow-rumped Tinkerbird *Pogoniulus bilineatus* (Short & Horne 2002), although G. R. Graves—whose elucidations of taxa known by few or single specimens (e.g. Graves 1992, 1996, 1998, 1999) have been particularly helpful, not least for the perplexed conservationist—has commented informally (verbally 1999) that, following a preliminary (two-hour) inspection of the type, the White-chested Tinkerbird seems likely to prove a good species.

An interesting case—and one which actually conflicts with Olson's thesis, since he regretted the reluctance of ornithologists 'to accept unique specimens as representing valid species'—is the 'Rufous-tailed Parrot' *Tanygnathus heterurus*. Forshaw (1989; previous editions in 1973, 1978) has always treated this under an independent heading, thus giving it at least the illusion of species status (reinforced by a most attractive illustration), despite the fact that his examination of the type suggested that 'it is probably an aberrant specimen of *T. sumatranus*'. Inskipp *et al.* (1988) revealed that over 500 true Blue-backed Parrots *T. sumatranus* (protected under Indonesian law) were traded in the period 1981–1985 under the name *T. heterurus* (unprotected under Indonesian law). They observed that 'it is imperative that the true nature of this taxon is resolved as soon as possible', not least because of the cover it appears to provide for illegal trade in another species. Despite this plea, we know of no recent interest in examining the type specimen afresh.

There are many such taxa whose type and only specimens await evaluation. A helpful feature of the old AMNH world checklist (Morony *et al.* 1975) was its asterisking of species of uncertain status, usually owing to a paucity of material. However, this practice only extended to those taxa which had somehow been given the benefit of the doubt; excluded were taxa which in some cases may simply have received a single negative assessment and thus fallen from sight, amongst them, for example, Spotted Green Pigeon *Caloenas maculata* (Anon. 1898, Peters 1937, Gibbs *et al.* 2001). A list of persistently dubious taxa, whether on or off world lists, is highly desirable as a working document for future researchers; however, the business simply of discovering the discarded yet inadequately evaluated taxa is likely to be problematic, and may only be achievable by a concerted pooling of information by collection managers, who are most likely to know of the oddities in their care. We encourage them to make a start; and it should go without saying that we regard the maintenance of specimen-based taxonomy and systematics as vital to the elucidation of the problems these specimens represent and indeed to the needs of conservationists in general over the coming decades.

Hopes and fears

We call this paper 'the archive and the ark'; we might just as easily have called it 'the anchor and the ark', because natural history museums are to conservation, and indeed to all biological science, the great link to the natural world, a key point of reference, and a mechanism for locking the management of natural resources into the hard substrate of science. These few examples help demonstrate the value of museum collections in one small but significant aspect of conservation work, relating to the documentation and management of threatened species—for a catalogue of other conservation uses see especially Remsen (1995)—and this paper has been written as an expression of gratitude to the many institutions which, over some 20

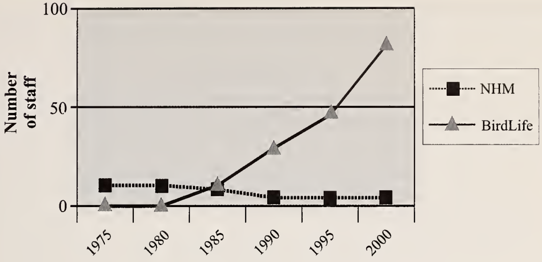

Fig. 6. Staff level changes in two institutions over the same period, 1975–2000: continuous line = BirdLife International Secretariat (including regional offices) executive staff (source: NJC); dashed line = Natural History Museum research and curatorial staff (source: F. E. Warr *in litt.* 2002), but note that the stabilised level from 1990 onwards represents the retention of curatorial staff only, with all research capability removed (see text).

years, have unfailingly made their material available for consultation and use by conservationists from BirdLife International.

It is also written as a gesture of support at a time when natural history museums are, in general, finding it increasingly hard to convince governments and institutions to provide for their vital work. It is as if their political masters have interpreted the close of the great era of exploration and discovery as an indication that there is no more work to do. It is true that a new era of work in natural history has begun—that of conserving as much as possible of the habitats that yielded up all those museum specimens in the previous hundred years or so—but this is not of course to say that such work should *replace* the work of museums. In the period 1975–2000, staffing levels within ICBP/BirdLife International, the world's leading bird conservation organisation, rose from one to almost 90 (9,000%). In the same period, research capacity at the Subdepartment of Ornithology at the Natural History Museum, Tring, where the largest single collection of avian museum material on earth is housed, was reduced by 90% (Collar 1997), with no full-time taxonomist or systematist being employed since 1988 (R. P. Prŷs-Jones verbally 1999; see Fig. 6). It hardly needs to be said that this circumstance is unpropitious. 'Without taxonomy to give shape to the bricks and systematists to tell us how to put them together,' wrote May (1990), 'the house of biological science is a meaningless jumble'. Conservationists are themselves dwellers in the house of biological science, and are likely to be the greatest losers in this scenario. One might go on to say that without taxonomy and systematists to keep the house of biological science orderly and functioning, museums become mausoleums and nature becomes a garden in which conservationists cannot tell weeds from wonders (and in which 'biological diversity' becomes the only, but now meaningless, binomen they can claim to be helping).

Curiously enough, however, some of the most immediate threats to museum specimen collections are from seemingly competitive internal pressures. Molecular studies have become so fashionable in the past two decades, and are apparently so much less expensive and so much more efficacious than more traditional museum science, that they have begun to marginalise specimen collections in the eyes both of space-stressed administrators pondering their budgets and of result-oriented academics planning their immortality. There is no short-term solution to this, but it is of vital importance that biochemical work complements and does not simply replace specimen-based analysis. Most of all, museums need to prove their continuing relevance by being *used*, and one measure to revive their fortunes in the face of official indifference or even hostility might be the re-importation of formal taxonomic studies into university curricula, so that biological research students will possess greater interest and confidence in designing all or part of their projects around the use of museum material.

This will, of course, depend on their being able to get into the institutions in question, which may not in the future be as simple a proposition as it once was. The new recognition that the biochemical properties of species can quickly become the legal properties of businesses has produced a sharp interest amongst parties to the Convention on Biological Diversity in asserting national rights of ownership over specimen material, and a tranche of impending prohibitions on researchers appears to be in the making. 'If implemented as proposed', Grajal (1999) has observed, 'most of the access laws will make biodiversity access permits more difficult for scientists to obtain than for mining concessions, tougher on museums than on hydropower development, and more cumbersome for herbaria than for logging companies'. Indeed, in our work towards the completion of *Threatened birds of Asia*, we were informed (by J. Hon *in litt.* 1999) that to gain access to the Kuching Museum in Sarawak foreign researchers must now obtain (1) a 'Permit to Access, Collect & Research on Biological Resources in Sarawak' from the Sarawak Biodiversity Centre, which entails completing a 20-page form and allowing a three-month processing period, and (2) permits of entry from both the Economic Unit and the State Planning Unit in Kuala Lumpur, which base their decisions in part on the issuance of the Sarawak research permit but which are reported to include other, undisclosed considerations in their decisions.

These new impediments to 'biodiversity prospecting' are understandable, but it will be heavily ironic if they also obstruct the real conservation of the resources in question. A dialogue is urgently needed between users of museums and the institutions that regulate such use in order to reach a fair accommodation of interests. In the same vein, recent requests made by some conservation organisations for full-scale museum 'data dumps', as a quick means of achieving an outward degree of authority in priority-setting exercises, have been greeted with scepticism or worse in some institutions, and they evidently risk causing a general backlash for inadequately acknowledging the professionalism, commitment and sheer expense that underpin the major specimen collections of the world today. Again, if this only serves to produce greater restrictions on access, the irony will be as withering as the effect.

Acknowledgements

Museum initials used in this paper are: AMNH, American Museum of Natural History; ANSP, Academy of Natural Sciences of Philadelphia; BMNH, The Natural History Museum, U.K.; CM, Carnegie Museum of Natural History, Pittsburgh; COP, Colección Ornitológica Phelps, Caracas; DMNH, Delaware Museum of Natural History, Greenville; EBD, Estación Biológica de Doñana, Seville; FMNH, Field Museum of Natural History, Chicago; ICN, Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogotá; IRSNB, Institut Royal des Sciences Naturelles, Brussels; LACM, Los Angeles County Museum of Natural History; LSUMZ, Louisiana State University Museum of Zoology, Baton Rouge; MCN, Museu de Ciências Naturais, Rio Grande do Sul; MCZ, Museum of Comparative Zoology, Harvard; MECN, Museo Ecuatoriano de Ciencias Naturales, Quito; MHNG, Muséum d'Histoire Naturelle de Génève; MHNJP, Museo de Historia Natural 'Javier Prado', Lima; MHNUC, Museo de Historia Natural, Universidad de Cauca, Popayán; MLZ, Moore Laboratory of Zoology, Occidental College, Los Angeles; MNHN, Muséum National d'Histoire Naturelle, Paris; MNHNM, Museo Nacional de Historia Natural, Montevideo; MNRJ, Museu Nacional de Rio de Janeiro; MRAC, Musée Royale de l'Afrique Centrale, Tervuren, Belgium; MZUSP, Museu de Zoologia, Universidade de São Paulo; NRM, Naturhistoriska Riksmuseet, Stockholm; RMNH, Rijksmuseum voor Natuurlijke Historie (now Naturalis), Leiden, Netherlands; ROM, Royal Ontario Museum, Toronto; SMF, Senckenbergmuseum, Frankfurt; UMZC, University Museum of Zoology, Cambridge, U.K.; USNM, United States National Museum, Washington DC; WFVZ, Western Foundation of Vertebrate Zoology, Los Angeles; YPM, Peabody Museum, Yale, New Haven; ZFMK, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn; ZMUC, Zoological Museum of the University of Copenhagen.

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